

nations. In the future we must look more to men and to ideas, and trust less to mere systems. Systems have had their trial. In particular, systems of examination have been tested and found wanting in nearly every civilised country on the face of the earth."

What we have written will show what food for thought in the matter of our present needs has been provided at Aberdeen for those gathered together for the advancement of science. Surely the three addresses to which we have specially referred in the present article suggest a gap in the organisation of the Association. Why should there not be a section to deal specially with the question of Education and Research?

THE "DECOMPOSITION" OF DIDYMIUM

UNDER the above title the *Chemical News* has recently reprinted from the *Chemiker Zeitung* a notice of an important piece of work recently communicated to the Vienna Academy by Dr. C. A. von Welsbach. The work appears to have resulted in the discovery that the "dyad or triad element" didymium with an "atomic weight" of 48 or 96, or 147, according to the text-books employed, and which since its separation by Mosander in 1841 has been investigated by Marignac, Hermann, Watts, Bunsen, Deville, and Erk, not to mention many others, is no element at all, but is built up of two substances which can be separated from each other by an ordinary chemical process. The "decomposition" was in fact effected by means of the double ammonium or sodium nitrates in presence of lanthanum salt.

The colours of the salts of the two substances are quite different. The salts of that which approaches lanthanum in its chemical characteristics are of a leek-green, those of the other substance are rose or amethyst red, and it is this substance which exists in greatest quantity in didymium. Dr. von Welsbach proposes for these two new substances the names of "praseodymium" and "neodymium."

It will be readily seen that from the chemical point of view alone these results are of very high interest, but there is another from which they assume a very great importance.

The "element" didymium after it was separated by the chemist had been handed over to the physicists. Gladstone, we believe, was among the first to note the characteristic absorption spectrum of the salts. In this work he was followed by Bahr and Bunsen, Erk and others. Thalén determined its spark spectrum, and in our spectroscopic literature didymium has taken its place by the side of hydrogen and iron as a characteristic spectrum-giving element.

Now one of the arguments which has been used in support of the view put forward some time ago of the dissociation of the chemical elements at solar temperatures is that at one "heat level" in the sun's atmosphere (a term coined because the sun's atmosphere must get hotter as we go down, and we have means of determining which vapours ascend from hotter regions and which descend from cooler ones) we get some lines of the spectrum of a substance, let us say iron, and at another we get others; so that to get the complete spectrum of iron, as we see it when we use iron in our laboratories, we have

to add together the two sets of lines seen in the spectra of parts of the sun known to be at different temperatures.

To make our statements more precise we may say that the lines of iron seen bright in the spectra of solar prominences and those seen widened in the spectra of solar spots are so different that it may be said that there is hardly a line common to both. So much so that, as was said years ago, if we did not know iron here, and the fact that its spectrum contains both sets of lines, we should say that the prominences *quæ* iron contained one substance, and the spots *quæ* iron contained another.

These facts were explained by the hypothesis that there were in the so-called element iron at least two different substances or molecular groupings, one of which alone could withstand the higher temperature of the prominences. The reason that *both* sets of lines and many others are seen in the spectrum of iron in the high-tension spark is that the temperature of the spark is sufficient to carry the solid metal through the series of simplifications, whether many or few, which lie between the limits formed by the solid state and the temperature of the prominences.

To this it has been objected that if these things exist in iron they should be isolated and put in bottles. To this it has been replied that the bottles themselves must be incandescent, or the "things" will unite again as they have done before to form iron as we know it.

Now the real importance of Dr. von Welsbach's work is that what has not yet been done for iron—to prove beyond all cavil the above hypothesis—he has done for didymium. He has got into two bottles, which we may mentally label "spot bottle," "prominence bottle," two substances from the "element" didymium, each of which has a characteristic spectrum consisting of different parts of the spectrum of didymium just as the spots and prominences have spectra *quæ* iron, which are different parts of the spectrum of iron. Further, by mixing the substances in these two bottles together in proper proportions he can produce a third, which gives the mapped spectrum of didymium exactly as in the general spectrum of the sun, in which we get, added together, the absorptions of the hotter and cooler regions represented by prominences and spots, we have *quæ* iron, something not unlike the arc spectrum of that substance.

There is no doubt that the interest of both chemists and physicists will be keenly excited by Von Welsbach's work, and that it will be critically examined and repeated. If it be confirmed we may hope that some day similar work will be undertaken here. The way is open, and has been cleared in a remarkable way. Formerly it was imagined that very high temperatures and new chemical methods were the sole agents to which appeal could be made in such a case; it may turn out that there are reagents to hand if chemists will turn their attention to them.

It is further clear that the "elements" with high atomic weight should be the first to be attacked. Those who consider the spectrum of cerium, for instance, which in the blue and violet portion is richer in lines than the spectrum of the sun itself, to be produced by the vibration of "the chemical atom" or "the chemical molecule," no matter which, will find themselves in a hopeless minority, now that the simpler explanation of a mixed

origin has apparently received confirmation in the case of another substance.

But although we have chiefly confined ourselves to the spectroscopic bearing of the work, it is not too much to say of it that, if this separation be in the sense as indicated, it is the most important work in mineral chemistry we have had for many years. By patient work the group of cerium, didymium, &c., metals has yielded several new metallic oxides, differing considerably from didymium, but having the same general reactions, being members of the same group in fact. The difference in the ordinary chemical reactions of cerium, lanthanum, didymium, scandium, terbium, ytterbium, and probably samarium is generally very slight, and they can only be separated by long-continued operations, nearly always cases of fractional separation. The close relationship of these metallic oxides has been long recognised, and the group has been considered peculiar in this respect, and in consequence an immense amount of labour has been expended upon it, more than has ever been expended on groups of other metallic oxides. Indeed, the notion that heat is the agent of chemical resolution seems to have gained such a hold that apparently for the last two, or three, decades, with the exception of the cerite metals, it is the only reagent the action of which has been taken as definitive in establishing a thing to be an element. We are not aware that any records of patient work on chromium exist, attempts to isolate any other substance from chromium oxide other than our ordinary chromium. The general properties of this, or these, oxides surely invite to further investigation. And in the case of nickel and cobalt, which appear almost to be isomers, there is a fine field for investigation which might be as profitably cultivated perhaps as an almost infinite series of carbon compounds.

OUR BOOK SHELF

Annuaire géologique universel et Guide du Géologie autour de la Terre. Par le Dr. Dagincourt. (Paris: Comptoir géologique de Paris, 1885.)

THIS is the first annual issue of a geological guide edited by the Secretary to the Geological Society of France, which cannot fail to be of the greatest use as a book of reference to those concerned with geology all over the world. *Multum in parvo* would be a very suitable motto for the book, for the amount of information which it contains in a small space is really marvellous. The editor does not profess to have carried out the whole of the programme which he has set before himself in the present issue; but it was decided to bring out the volume this year on account of the meeting of the Geological Congress at Berlin, and also in order that he may be able in the ensuing issue to profit by private and public criticism. The best criticism of it will be a bare statement of its contents. It first describes the history, various meetings and utility of the Congress of Geologists, with the proceedings at the meetings in Paris and Bologna. It then takes the continents in alphabetical order, and the countries in them in the same way, and supplies a mass of geological information of all kinds with regard to each. Taking as an example the first country under the head Europe, which is Germany (Allemagne), we find a list of books on the bibliography of German geology, of general (as distinguished from special and detailed) geological maps, and of the leading works on certain districts; these are succeeded by a general sketch of the geological features of Germany, and of the occurrence of the various

geological systems, then a detailed account of the organisation for the production of geological maps in the various countries and provinces composing the German Empire; then a sketch of the institutions in which geology is taught, the various universities with their professors, laboratories, collections, museums, &c., the professors at the various polytechnic and agronomical schools, the public and private geological collections, with in some cases, brief descriptions of the principal features (these occupy a considerable space), then the various geological societies, with their organisations; next the periodical publications, their prices, size, general nature of the contents, divided into five classes—(1) those specially geological, (2) those containing from time to time geological papers, (3) geographical periodicals containing geological papers, (4) those devoted to mining, (5) collections of geological and palæontological memoirs. These lists are succeeded by others which form a very important feature of the work—viz. the names, addresses, and special fields of all the geologists in the German empire; and finally the titles of all the books and papers which have appeared during the past year on mineralogy, petrography, geology, and palæontology, arranged in alphabetical order. This description of the volume under the head “Allemagne,” will give an accurate idea of the scope and arrangement of the book, for although circumstances have prevented the scheme being carried out with the same degree of thoroughness for every part of the globe, the volume will year by year approach nearer to, doubtless even improve upon, this standard. In the case of Great Britain, for instance, the issue for 1886 will contain a thorough study of our geology, and its teaching in our universities and other public institutions. Its ultimate completeness must naturally depend much on the assistance which the editor receives from geologists all over the world in supplying information, making the necessary alterations required by time, offering suggestions and adding corrections; and the volume is so useful and full in design that we have little doubt Dr. Dagincourt's fellow-geologists will willingly help him to carry it out in all its details. We observe that Tasmania has by an error been put amongst Asiatic countries instead of in Australasia.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

The Meteoric Cycle and Stonehenge

WE are now passing through the hundredth meteoric cycle of nineteen years, which commenced with A.D. 1882, and will terminate with A.D. 1900. These cycles began with the year of our Saviour's birth, and our prayer books contain tables showing for many successive years on what days Easter days and our movable festivals will occur. At the end of every such cycle the new and full moons happen within an hour and a half of the same time of the year as they did at the beginning.

With these cycles is commonly associated the name of Meton, an astronomer of Athens, who wrote a book on the subject, by which the Greeks regulated the recurrence of their festivals. He flourished 432 years B.C. But the knowledge of these cycles existed in England centuries before the time of Meton, as I will presently show, and it is probable that the four very ancient erections supposed to have been temples of the sun near Penzance, had reference to this cycle of nineteen years, as they each consisted originally of nineteen stones placed upright and rising from 3 to 6 feet above the ground in rude circles varying in diameter from 65 to 80 feet. These temples are still existing, although some of their stones have fallen, and they are miles from each other, but are all called in the printed maps, as well as immemorially, by one and the same name, viz. “Nine